

CLAIMS

1. A method for treating a fluid comprising:
 - a) providing raw fluid to a process tank;
 - b) adding an ion-exchange resin to the process tank to form a raw fluid/ion-exchange resin mixture;
 - c) removing treated fluid from the process tank through a membrane filter, wherein said process tank contains said membrane filter; and
 - d) regenerating the ion-exchange resin in the process tank.
2. The method of claim 1 wherein the ion-exchange resin is a magnetic ion-exchange resin.
3. The method of claim 1 further comprising agitating the raw water/ion-exchange resin mixture sufficiently to maintain the ion-exchange resin in suspension.
4. The method of claim 1 further comprising reusing a regenerant in multiple regeneration steps.
5. The method of claim 4 further comprising filtering the regenerant to restore its regenerative properties.

6. A method for treating fluid comprising:
 - a) providing raw fluid to a process tank;
 - b) adding a magnetic ion-exchange resin to the process tank to form a raw fluid/magnetic ion-exchange resin mixture;
 - c) removing treated fluid from the process tank through a membrane filter, wherein said process tank contains said membrane filter; and
 - d) separating the magnetic ion-exchange resin from the raw fluid/magnetic ion-exchange resin mixture using a magnetic separator.
7. The method of claim 6 further comprising regenerating the magnetic ion-exchange resin.
8. The method of claim 7 further comprising providing the regenerated magnetic ion-exchange resin to the process tank.
9. The method of claim 7 wherein the regenerating step is performed in an external column.
10. The method of claim 7 wherein the regenerating step is performed in the process tank.
11. The method of claim 7 further comprising reusing a regenerant in multiple regeneration steps.

12. The method of claim 11 further comprising filtering the regenerant to restore its regenerative properties.

13. A method for treating a fluid comprising:

a) providing an up-flow bed containing an ion-exchange resin within a portion of a process tank;

b) flowing a stream of the fluid through the up-flow bed;

c) removing treated fluid from the process tank through a membrane filter, wherein said process tank contains said membrane filter; and

d) regenerating the ion-exchange resin in the up-flow bed portion of the process tank.

14. The method of claim 13 further comprising reusing a regenerant in multiple regeneration steps.

15. The method of claim 14 further comprising filtering the regenerant to restore its regenerative properties.

16. A method for treating a fluid comprising:

- a) providing an up-flow bed containing an ion-exchange resin with an outlet of the up-flow bed being in fluid communication with a process tank;
- b) flowing a stream of the fluid through the up-flow bed, out of the outlet and into the process tank;
- c) removing treated fluid from the process tank through a membrane filter, wherein said process tank contains said membrane filter; and
- d) regenerating the ion-exchange resin in the up-flow bed.

17. The method of claim 16 further comprising reusing a regenerant in multiple regeneration steps.

18. The method of claim 17 further comprising filtering the regenerant to restore its regenerative properties.

19. A method for treating a fluid comprising:
- a) providing raw fluid to a process tank;
 - b) adding an ion-exchange resin to the process tank to form a raw fluid/ion-exchange resin mixture;
 - c) removing treated fluid from the process tank through a membrane filter, wherein said process tank contains said membrane filter;
 - d) regenerating the ion-exchange resin with a regenerant in a regeneration step;
 - e) recycling the regenerant for use to regenerate the ion-exchange resin in multiple regeneration steps; and
 - f) recovering a portion of the spent regenerant by membrane separation of the regenerant and contaminants.

20. A method of regenerating an ion exchange resin used to treat a fluid in a process tank, the method comprising:

- a) removing the treated fluid from the process tank, while retaining a substantial portion of the ion exchange resin within the process tank;
- b) adding a resin regenerant to the process tank; and
- c) removing the regenerant from the process tank, while retaining a first portion of the ion exchange resin within the process tank.

21. The method of claim 20 further comprising mixing the resin and the regenerant.

22. The method of claim 20 further comprising rinsing the ion exchange resin within the process tank after removing the regenerant.

23. The method of claim 20 further comprising adding a second portion of ion exchange resin to the process tank to make up ion exchange resin lost to the system.